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THE VIRGINIA JOURNAL OF SCIENCE

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April, 1961

THE VIRGINIA JOURNAL OF SCIENCE

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THE VIRGINIA
JOURNAL OF SCIENCE

Vol. 12, New Series | April, 1961 | No. 2

Distribution of the Sum of Independent Uniform Random Variables with Unequal Ranges

Victor Chew

Operations Research Branch
U. S. Naval Weapons Laboratory
Dahlgren, Virginia

1. *Introduction*

While working on a War Games problem, it became necessary to obtain the distribution of the sum of independent uniform variables. The Central Limit Theorem insures under fairly general conditions that the sum of n such random variables is asymptotically normal, but in practice n is small so that the normal approximation is unsatisfactory and the exact distribution is necessary.

The required distribution is easily obtained using the Convolution Theorem. This theorem does not seem to have received the attention it deserves. It is discussed in the textbooks by Feller (1957) and Kendall and Stuart (1958) but is not mentioned by Anderson and Bancroft (1952), Cramer (1957), Fraser (1958), Hoel (1960), Hogg and Craig (1959) and Mood (1950). The theorem states that if x and y are independent random variables with density functions $f(x)$ and $g(y)$ respectively, the density function of $u = (x + y)$ is given by

$$h(u) = \int_{-\infty}^{\infty} f(u - y)g(y)\,dy \qquad (1)$$

2. *Sum of Two Independent Uniform Random Variables*

Without losing generality, we can assume that the two independent uniform random variables x and y have ranges $(0, a)$ and $(0, b)$ respectively with $b \geq a$. The density functions of x and y are then

$$f(x) = 1/a, \quad 0 \leq x \leq a \qquad (2)$$
$$= 0, \text{ elsewhere}$$

and

$$g(y) = 1/b, \quad 0 \leq y \leq b \qquad (3)$$
$$= 0, \text{ elsewhere}$$

The density function of $u = (x + y)$ is therefore

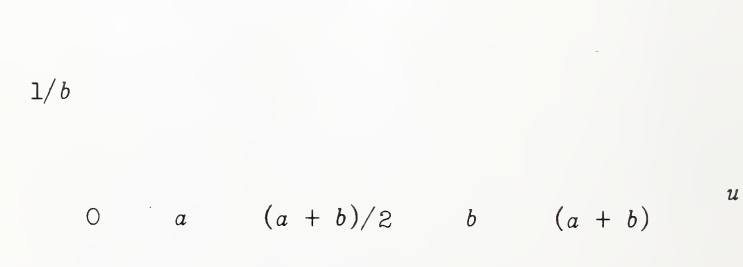
$$h(u) = (1/b) \int_{o}^{b} f(u - y)\,dy = (1/b) \int_{u-b}^{u} f(x)\,dx \qquad (4)$$

Integrating eqation (4) we obtain Table 1, which also gives the cumulative distribution function of u.

Table 1. *Density and Distribution Functions of* $u = (x + y)$

Value of u	Density Function of $h(u)$	Distribution Function of $H(u)$
$u \leq 0$	0	0
$0 \leq u \leq a$	u/ab	$u^2/(2ab)$
$a \leq u \leq b$	$1/b$	$(2u - a)/(2b)$
$b \leq u \leq (a + b)$	$(a + b - u)/(ab)$	$1 - \{(a + b - u)^2/(2ab)\}$
$u \geq (a + b)$	0	1

The graph of the density function $h(u)$ is shown in Figure 1. The graph is symmetrical about the mid range of u. If the variables start from c and d instead of at O, it is necessary only to shift the graph to the right by an amount $(c + d)$. If the ranges of x and y are equal, the distribution of u is triangular.



It is easy to show that the mean of x is $a/2$ and that its variance is $a^2/12$. The mean of u is thus $(a + b)/2$ and, since x and y are independent, the variance of u is $(a^2 + b^2)/12$.

Higher moments of u, if required, are most readily obtained by use of the moment generating function (m.g.f.). The m.g.f. of x is $(e^{at} - 1)/at$. Applying the well-known result that the m.g.f. of the sum of independent random variables is equal to the product of the m.g.f's and picking out the coefficient of $(t^r/r!)$ in the m.g.f. of u, we have the r-th moment of u about the origin is

$$\mu'_r = \{(a + b)^{r+2} - (a^{r+2} + b^{r+2})\}/(r + 1)(r + 2)(ab) \qquad (5)$$

3. *Sum of Three Independent Uniform Random Variables*

We may assume that the three variables x, y and z start at the origin and have upper limits a, $b \geq$ and $c \geq b$ respectively. Let $v = (x + y + z) = (u + z)$, where $u = (x + y)$. To obtain the density function of $v = (u + z)$, we apply the convolution theorem again, using the density function of u already obtained in section 2. If $h(u)$ and $p(v)$ are the density functions of u and of v respectively, we have

$$p(v) = (1/c) \int_{v-c}^{v} h(u)\,du \qquad (6)$$

Table 2 gives the solution of (6) together with the distribution function of v. In this table, min $(c, a + b)$ stands for the smaller of the two numbers c and $(a + b)$ and max $(c, a + b)$ for the larger of the two.

The graph of the density function $p(v)$ is shown in Figure 2, for the case where $c > (a + b)$. The graph is symmetrical about the mid-range of v. (If $c < (a + b)$ the graph has a unique maximum at the mid-range.)

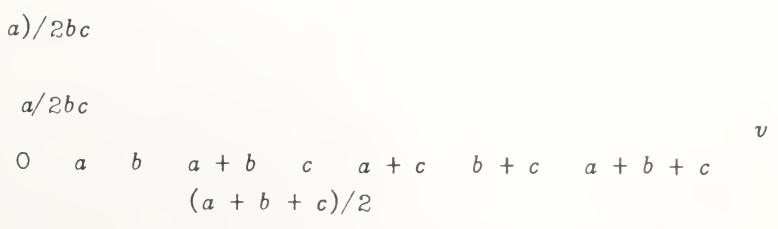


Table 2. Density and Distribution Functions of $v = (x + y + z)$

Value of v	Density Function $\phi(v)$	Distribution Function $P(v)$
$v \leq 0$	0	0
$0 \leq v \leq a$	$v^2/(2abc)$	$v^3/(6abc)$
$a \leq v \leq b$	$(v^2 - (v - a)^2)/(2abc)$	$(v^3 - (v - a)^3)/(6abc)$
$b \leq v \leq \min(c, a + b)$	$(v^2 - (v - a)^2 - (v - b)^2)/(2abc)$	$(v^3 - (v - a)^3 - (v - b)^3)/(6abc)$
$\min(c, a + b) \leq v \leq \max(c, a + b)$	$(v^2 - (v - a)^2 - (v - b)^2 - (v - c)^2)/(2abc)$ if $c \leq (a + b)$	$(v^3 - (v - a)^3 - (v - b)^3 - (v - c)^3)/(6abc)$ if $c \leq (a + b)$
	or $1/c$, if $c > (a + b)$	or $(2v - a - b)/(2c)$, if $c > (a + b)$
$\max(c, a + b) \leq v \leq (a + c)$	$(2ab - (v - c)^2)/(2abc)$	$(3ab(2v - a - b) - (v - c)^3)/(6abc)$
$(a + c) \leq v \leq (b + c)$	$(a + 2(b + c - v))/(2bc)$	$(6bc - a^2 - 3a(b + c - v) - 3(b + c - v)^2)/(6bc)$
$(b + c) \leq v \leq (a + b + c)$	$(a + b + c - v)^2/(2abc)$	$(6abc - (a + b + c - v)^3)/(6abc)$
$v \geq (a + b + c)$	0	1

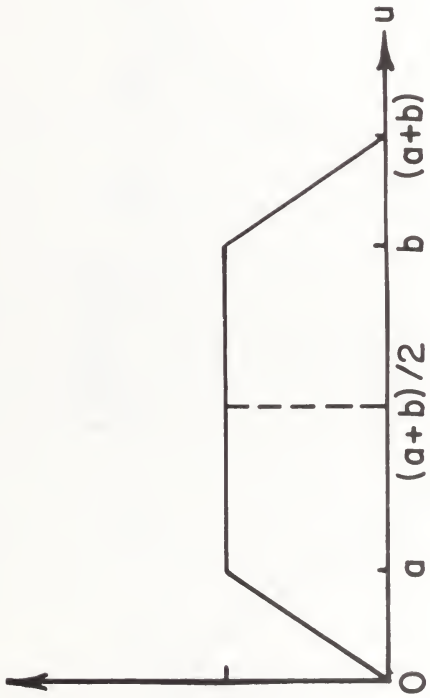


Figure 1. Graph of Density Function of u = (x + y)

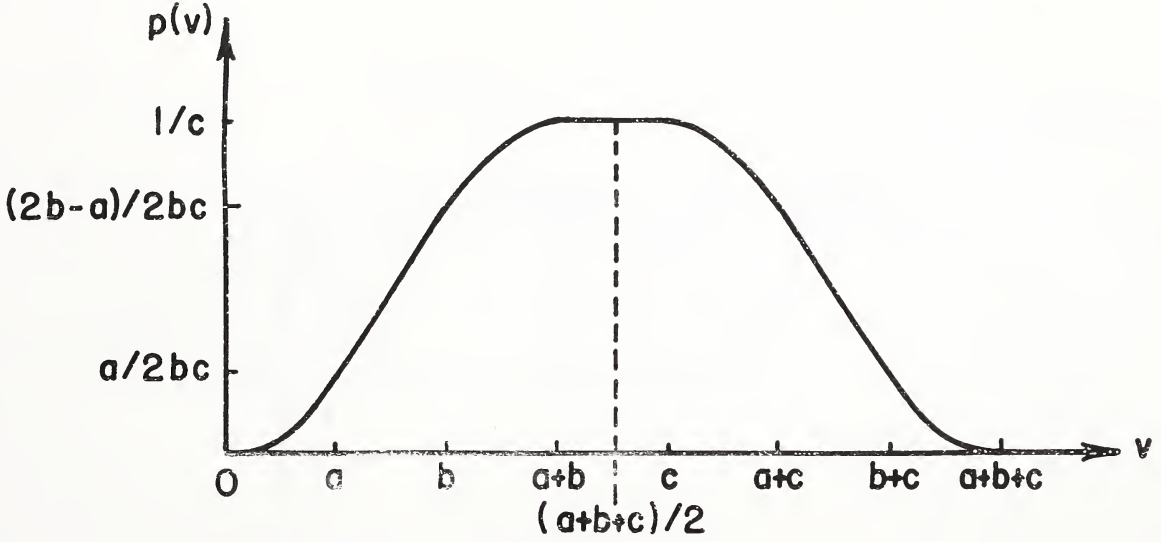


Figure 2. Graph of Density Function of $v = (x + y + z)$

To illustrate the use of Table 2, suppose that we are going to take an observation from each of three uniform distributions with ranges 1, 2 and 4 and we want to find the probability that the sum of the three observations will be less than 4.5. Here $a = 1$, $b = 2$ and $c = 4$. Substituting these values and $v = 4.5$ in the distribution function $(3ab(2v - a - b) - (v - c)^3)/(6abc)$, we find that the required probability is 0.7474.

Using methods similar to those employed in the previous section, it is easy to prove that the r-th moment of v about the origin is

$$u'_r = [(a + b + c)^{r+3} - \{(a + b)^{r+3} + (a + c)^{r+3} + (b + c)^{r+3}\} + (a^{r+3} + b^{r+3} + c^{r+3})]/(r + 1)(r + 2)(r + 3)(abc) \quad (7)$$

The mean of v is $(a + b + c)/2$ and its variance is $(a^2 + b^2 + c^2)/12$ either from (7) or directly from the independence of x, y and z.

4. *Sum of Four or More Independent Uniform Random Variables*

It has not been necessary in this work to obtain the distribution of the sum of 4 or more independent uniform random variables. If necessary, the distribution of $w = (x + y + z + s)$ can be obtained by writing $w = (v + s)$ and applying the convolution theorem again, using the distribution of v already obtained. The general distribution of w is complicated by the numerous possibilities concerning the relative magnitudes of c, d, $(a + b)$, etc., where d is the range of s. The mean and varience of w can of course be written down immediately. The extension of equation (7) to give the r-th moment of w about the origin is fairly obvious. However, reference to Figure 2 indicates that for four or more variables, the normal distribution should provide satisfactory approximation for most practical purposes, unless one of the variables dominates the sum.

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EDITOR'S NOTE

The Virginia Journal of Science is, in the Editor's name, a member of the Conference of Biological Editors. This Conference meets once a year to hear reports given by committees assigned to study special problems of editors and managers of scientific journals. The advice of editors in other fields of science is sought so that the proceedings of the Conference are of general interest, and are not confined exclusively to the needs of the biological sciences.

At the fifth annual meeting of the Conference, held at the Rockefeller Institute, New York City, New York, February 3-4, 1961, criteria for accepting manuscripts received special attention. Dr. Karl F. Schmidt (of Circulation Research) chaired a panel which discussed this subject.

The Panel agreed that there can be no uniform standard procedure for the acceptance of manuscripts, but that the editor does his best to supplement his opinions with those of expert advisors. Among considerations upon which acceptance should be based, the Panel cited two: (1) the encouragement of definitive publications as contrasted with a series of brief contributions; (2) presence of new data representing a definite advance and particularly not duplicating publications by the author or by others.

Dr. Paul Weiss, of the University of Chicago, delivered the key address, "Research Strategy and Publication Policy." His speech emphasized points brought out by Dr. Schmidt. It is abstracted here, together with some points emphasized in Dr. Weiss's address. Members and prospective authors of papers may find further amplification in Weiss (1945, cited above).

There is a "publication explosion" caused by mass production of research, the rapid expansion of the sciences and emergence of a high degree of specialization. Excessive publication and develop-

ment of technological jargon has created a failure in science communciation. Remedies are necessary. Some cherished beliefs will have to be abandoned. One of these is that any unrecorded datum is worth publishing. There is the belief that the number of printed pages is an index to a man's research ability. Others believe in the democratic principle that each one must have his say. The invention of a new word is thought to lend profundity to research. This has led to the publication of numerous papers in which the data alone seem to be the sole objective. Data is not knowledge, but the food of knowledge. Data must be digested, organized and used to document a new concept. It is a perversion of science teaching to confine one's self to factual papers and to coin unnecessary synonyms. Editors should discourage duplication of terminology as well as the duplication of an author's own work or the work of others. The editor should be courageous enough to sort the trivial from the significant. The author should be compelled to make "good case" to get published. The editor should give good reasons for rejecting a paper. Editorial boards are not obliged to provide a public forum. Authors should be discouraged from recapitulating their own ontogenetic research growth. Editors should not adopt a policy of scarcity, but one of stock taking.

The *Journal*'s policy on acceptance criteria are based on the suggestions cited above. Factual papers are not discouraged, for many are worth publishing and new data are always of interest to the profession. If a choice has to be made, however, it must be recognized that a well-written, factual article ranks below a paper with a thoroughly documented new idea.

The scientfic merits of manuscripts are judged by the reviewers, the Section Editor and the Editor. Some leading questions in their minds are: is the problem well conceived? Is the paper clearly written and well organized? Classical form (introduction, literature review, materials, methods, procedue, conclusions and summary) are recommended but not necessary to a well organized paper. Evidences of scholarship and sound methodology are judged primarily by the reviewers and the Section Editor. Appropriate style is determined primarily by the Editor. Final selection of manuscripts to be published is made by the Editor with regard to the scientific worth of the papers and budgetary limits. Before any manuscript is rejected the Editor secures additional review, other than that called for by the Editorial Board.

Minutes of Council Meeting, Newcomb Hall University of Virginia

NOVEMBER 6, 1960

The meeting was called to order by President Bell at 10:15 A. M. Present were Walter S. Flory, Jr., Miss Susie V. Floyd, John C. Forbes, William G. Guy, Col. S. M. Heflin, Horton H. Hobbs, Jr., Harry G. M. Jopson, Robert D. Ross, William W. Scott, Jackson J. Taylor, William B. Wartman, Jr., and Stanley B. Williams.

The reading of the minutes of the meetings during the last annual meeting were dispensed with as they had been circulated.

Col. Heflin, chairman of the committee on Local Arrangements for the VAS meeting in Lexington for 1961 reported on housing facilities, meeting rooms and other facets of preparation.

A schedule prepared by the Chairman of the Medical Section for the Secretary was read by President Bell, revised and adopted as the schedule to be sent to all section chairmen. Its principal innovation was advancing the schedule for the call for papers to be made in December instead of February as has been customary.

Dr. Flory, chairman of the Long Range Planning Committee outlined past projects and current problems and inquired whether the committee was primarily concerned with producing ideas or implementing approved projects. After some discussion, it was concluded that it was an idea committee together with the formulation of implemental procedures to be submitted to Council for approval.

Mr. Wartman read the report of Mr. Harlow, chairman of the committee on Business Memberships indicating six new members were added this year to make a total of seventeen firms. Two others contributed the membership fee but could not become members for policy reasons. Dr. Hobbs moved, and it was approved that Council receive the report and that the President write Chairman Harlow commending his committee on their excellent work. A discussion of merging the two membership comtees ensued but action was postponed until after a discussion with the two chairmen could be arranged.

Dr. Scott reported for the Junior Academy Committee and pointed out that the decision had been made to emphasize research and discourage gadgetry in the projects to be entered for competition. Further the Junior program would include the formal presentation of papers by Junior Academy participants. He pointed out that the preliminary regional exhibitions had been expanded with two more colleges partici-

pating. Studies had been planned to see where the best talent goes to college and also an effort to encourage the offering of more scholastic aid for them from Virginia colleges. He also brought up the subject of collegiate membership which was discussed and turned over to the Long Range Planning Committee.

For Visiting Scientists Committee, Dr. Forbes reported that most of the colleges in the state had already secured a visiting scientist for a two day period for this session. President Bell reported on a proposed application to NSF for visiting scientists for high schools. After discussion, it was decided for several reasons that the application should be postponed for a year.

Dr. Guy reported for Miss Boggs for the History of Science Committee. It was pointed out that AAAS initiated this study in the state academies for source material for a history of the rise of the state academy movement in the U. S.

President Bell called attention to the scheduled meetings of the Academy as follows: 1961, May 11-13, V.M.I., Lexington; 1962, May 9-12, Norfolk Division of William and Mary, Chamber of Commerce and City Council, Norfolk; 1963, May 1-4, Hollins and Roanoke Colleges and VPI, Hotel Roanoke, Roanoke. He called to the attention of Pesident-elect Hobbs that he should make arrangements for the 1964 place of meeting to be decided at the 1961 Academy meeting.

Virginia Journal of Science editor, Dr. Ross reported he was unable to secure the services of an advertising agency for the Journal. He further outlined the financial condition of the Journal as operating for the year in the black.

Dr. Taylor, reporting for the Research Committee said that two applications had been received but that these exceeded the research funds presently available, namely, $600. He called attention to the Horsley Award in last year's Academy bulletin was stated as $150, and the Secretary was instructed to see if Council had ever authorized the incease over the traditional $100.

Concerning the recommendation for the reorganization of Council (Council minutes of May 12, 1960), the President was requested to form a committee to study this suggestion and make recommendations. President Bell announced that he would do this in the framework of the Long Range Planning Committee. At the same meeting of May 12th, it was recommended that the Chairman of the Junior Academy Committee be a member of Council. At the present meeting, Dr. Forbes moved that the holder of this office be an ex-officio member of Council. The motion was unanimously passed. Since this is a constitutional change, it requires

publication pror to the action o fthe Academy. These minutes serve as publication notice. Adjournment.

Submitted by,
Paul H. Patterson, Secretary.

Council Meeting, Newcomb Hall University of Virginia

MARCH 12, 1961

President Bell called the meeting to order at 10:00 a.m. with the following present:

J. G. Barker, R. P. Carroll, H. W. K. Fitzroy, W. S. Flory, J. C. Forbes, W. G. Guy, S. M. Heflin, W. M. Hinton, H. H. Hobbs, L. R. Hundley, H. Leidheiser, Jr., J. B. Newman, J. J. Taylor, R. D. Ross, W. W. Scott, F. F. Smith, W. B. Wartman, Jr. and S. B. Williams.

The reading of the minutes was dispensed with since they had been circulated.

Mr. Smith gave a brief Treasurer's report with the estimated income prepared by the Finance Committee for 1961 at $9,005.00.

Colonel Heflin, Chairman of the Local Arangements Committee reported on space assignments at V. P. I. for the May meeting. He mentioned plans for a reception Friday afternoon and plans for entertainment of ladies Friday morning. Colonel Newman reported plans for social activities for Junior Academy members. Colonel Carroll reported on tentative plans for a number of field trips for Saturday.

Dr. Leidheiser proposed a symposium on research on Virginia's natural resources for the Saturday following the Academy Meetings in 1962. He proposed that nationally known persons be invited to speak. He further proposed that these speakers and their subjects be placed in the hands of a committee of four, two of which would be from the Virginia Institute for Scientific Research, and two Academy members. He said all expenses would be met by the Institute. Council passed a motion by Dr. Flory that the Academy approve the plans for the symposium with approbation for the Institute's cooperation. President Bell will appoint the Academy's members to this committee. It was suggested that this information be made available to section chairmen for possible adjustment in their 1962 programs.

The Institute has land for a new laboratory and is attempting to raise

$350,000 for its construction. $160,000 is now in hand or pledged and $190,000 is yet to be raised. Mr. Wartman spoke concerning this and suggested that Academy members may wish to cooperate in fund raising. Council passed a motion made by Mr. Taylor to the effect that Council cooperate with the Board of Directors of the Institute in raising funds in support of the Institute's building program. Dr. Leidheiser expressed appreciation for Council's cooperation. Dr. Forbes suggested one room in the new laboratory might be set aside as a Board Room for the Academy.

Dr. Bell indicated the possible desirability of combining the two membership commitees and this matter is being studied by the committees and a report will be made to Council in May.

Colonel Fitzroy reported that nearly all Virginia Colleges were participating in the Visiting Scientists Program. He reported that N.S.F. had withdrawn support for Visiting Scientists through State Academies because of a Federal regulation which limits the per diem stipend through Academy channels to an unrealistically small figure. N. S. F. will increase its underwriting of Visiting Scientists Programs with 14 major national professional societies since they may by law give realistic per diem fees. Council passed a motion by Dr. Hobbs, that Colonel Fitzroy continue his investigation of alternate methods to continue the program of Visiting Scientists.

The feasibility of initiating a visiting Scentists Program for high schools was further discussed (minutes of November 6, 1960). The matter will be pursued by last year's Committee.

Dr. Flory reported for the Long Range Planning Commitee. The several items proposed were unanimously passed by the Committee.

The first item concerned a reorganization of council to effect better representation of the Academy. The recommendation concerns only the elected members. The rest of the structure of Council remains as it is at at present. That one member to Council be elected by each section whose term of office will be three years. That the present elected council members (not those present because of their office) represent the sections they are affiliated with until their terms normally expire. In order to give continuity to the elected members a rotation of groups of Sections was recommended. Agricultural Sciences, Astronomy, Mathematics and Physics would elect a member for one year in 1961 and start the 3 year terms in 1962. Science teachers currently represented by Miss Floyd would go on the three year election basis in 1965. Bacteriology, Chemistry and Engineering would elect in 1961 a member for two years and elect for three year terms in 1963. Biology currently represented by Dr. Jopson would elect for three year term in 1963. Geology, Medical Sciences and Statistics would elect for a three year term in 1961. Psychology now represented by

Dr. Wililams would elect in 1964. Council passed unanimously Flory's motion for the adoption of the above. The secretary was directed to inform Section Chairmen and Secretaries before the May meetings.

The second item resulted from a concern with regards to the Academy's unorganized efforts with regard to Science teaching in the state and the Committee recommended that a committee be set up to study science teaching in the schools and colleges in Virginia. Council passed Dr. Flory's motion to set up the Committee. However, questions as to its composition, size, membership, rotation, etc. were postponed.

Dr. Flory's Commitee was concerned with the slowness of the appearance of the Dismal Swamp Project and made several recommendations. After discussion, Council passed Dr. Forbe's motion that action be tabled until discussion with Dr. Baldwin was had.

Dr. Flory announced that the "complete Annotated List of the Plants of Virginia" by A. B. Massey is expected to be distributed in duplicated form by the May meeting.

The next item the Long Range Committee presented was the need for a well balanced permanent Committee concerned with the natural resources of Virginia viewed broadly: scenic beauty, water and air pollution, wild life, mineral and other natural wealth. Council approved Dr. Flory's motion that such a Committee be formed as soon as possible.

Dr. Flory's Committee recommended "that Council study the problems of, and implement as soon as possible, the employing of a permanent Executive Secretary for the Virginia Academy of Science in order to press the needs of Science in the State." Council passed Dr. Flory's motion that this recommendation be accepted with its study and implementation.

Mr. Taylor, Chairman of the Research Committee, reported two research grants had been awarded and several others were under consideration.

Dr. Scott, in reporting on the activities of the Junior Academy of Science, said that abstracts are now required of projects prepared for exhibition. From these, collection and gadget types of exhibits will be eliminated and research types will be invited to be exhibited by the review panel. He further reported that the May meetings had been planned almost entirely by the Juniors and they are planning a session for the reading of invited papers from the Juniors. They are celebrating their 20th anniversary with a ball. The current membership is 2,000.

Dr. Ross, editor of the Journal, reported that the acute problem of storing the back issues of the Journal has been solved by putting them on shelves, built for this purpose in the basement of his home. The expendi-

ture of $320.00 for shelves, taken from the Journal budget is being referred to the Committee on Finance for possible reimbursement. Council passed Mr. Wartman's motion to this effect.

Dr. Hobbs sought the Academy's backing of an effort to set aside Mt. Rogers on the Grayson-Smyth County line as a natural preserve. Council passed a motion by Dr. Flory that Council go on record as approving such a move.

Mr. Smith suggested that the Long Range Planning Committee study the feasibility of securing guest speakers from outside of the Academy for individual sections of the Academy. No action was taken.

Adjournment

P. M. Patterson
Secretary

Report to Long Range Planning Committee

VIRGINIA ACADEMY OF SCIENCE

BY

SUBCOMMITTEE TO CONSIDER ADEQUATE REPRESENTATION ON THE ACADEMIC COUNCIL

Your committee recommends that:

I. The elected members of the council be nominated by the various sections of the academy and that there be one elected member for each section.

II. The term of office of the elected council members be changed from five to three years.

III. In order to give continuity to the elected council that at the first election (1961), 1/3 of the council would be elected for a one year term, 1/3 for a two year term, and 1/3 for a three year term. Thereafter all members will be elected for a three year term.

IV. That the present elected council members serve out their present terms representing their respective section. (A proposed-schedule of elections for this transition period is attached).

V. The council be empowered to adjust election of council members to fit into above scheme as sections are added or discontinued.

VI. The subcommittee be discharged.

Respectfully submitted,

Dr. Boyd Harshbarger
Dr. W. M. Hinton
Dr. J. C. Thompson
Dr. F. L. Hereford
Dr. S. S. Obenshain, Chairman

March 5, 1961
Attachment

SCHEDULE OF ELECTION OF COUNCIL MEMBERS,

VIRGINIA ACADEMY OF SCIENCE

	Elected for 1961	Subsequent Elections 1962	1965
Agricultural Sciences	1 year	"	"
Astronomy, Mathematics, and Physics	1 year	"	"
Herbert W. K. Fitzroy	—	X	X
Science Teachers (Miss Susie V. Floyd)	—	—	1965
Bacteriology	2 years	1963	1966
Biology (H. G. M. Jopson)	—	"	"
Chemistry	"	"	"
Engineering	"	"	"
Geology	3 years	1964	1967
Medical Sciences Psychology	"	"	"
(S. B. Williams)	—	"	"
Statistics	"	"	"

Virginia Academy of Science

Program

OF THE

Thirty-Ninth Annual Meeting

LEXINGTON, VIRGINIA

May 10-13 1961

(EASTERN DAYLIGHT SAVING TIME)

General Program of the 39th Annual Meeting

EXHIBITORS, MALLORY HALL

WEDNESDAY, MAY 10, 1961

3:00 p.m. to 10:00 p.m.	Registration, Junior Academy of Science. Room 354, Mallory Hall. Arrangements of Exhibits in gymnasium.
7:30 p.m.	Meeting VJAS Executive Committee. Room 359, Mallory Hall.
8:00 p.m. to 10:00 p.m.	Juniors may attend programs at Planetarium. The Planetarium will seat 40 people at one time. It is located behind Preston Library.

THURSDAY, MAY 11, 1961

8:00 a.m. to 9:00 a.m.	Registration and arrangement of exhibits. Room 354, Mallory Hall and gymnasium.
9:00 a.m. - 12:00 p.m.	Judging of Exhibits. Virginia Science Talent Search interviews. Judges in the Virginia Science Talent Search: Preston Library, rooms 301, 302, 313, 317, 321. Judges in Exhibits use rooms near gymnasium floor.
1:15 p.m.	Section of Science Teachers. Room 111, Mallory Hall.
2:00 p.m.	Meeting of Council of the Academy. Room 334, Mallory Hall.
1:15 p.m.	Section of Science Teachers. Room 111, Mallory Hall.
1:30 p.m. to 3:30 p.m.	VJAS Annual Business Meeting. Room 310, Auditorium, Preston Library.
2:00 p.m.	Meeting of the Council of the Academy. Room 334, Mallory Hall.
3:30 to 5:30 p.m.	Presentation of research papers by Junior Science Day Winners, and Virginia Science

	Talent Search winners. Room 310, Auditorium, Preston Library.
4:30 p.m.	Meeting of Section Editors. Room 359, Mallory Hall.
5:30 p.m.	VJAS Executive Committee Meeting. Room 359, Mallory Hall.
8:00 p.m.	Annual Academy Conference. Room 147, Mallory Hall.
8:00 p.m. to 10:30 p.m.	VJAS Twentieth Anniversary Ball. White students Waddell School; colored students Lylbur High School.

FRIDAY, MAY 12, 1961

8:30 a.m. to 10:00 a.m.	Registration. Room 354, Mallory Hall.
	Section Meetings. See detailed section of Program.
9:30 a.m.	Historical Tour of Lexington, Mallory Hall. Leaders: Colonel W. Cooper and Mrs. S. M. Heflin.
12:00 p.m.	VJAS Awards Hours. Room 310, auditorium, Preston Library.
12:00 p.m.	Long Range Planning Committee. Room 359, Mallory Hall.
12:00 p.m.	Virginia Floral Commitee, Room 334, Mallory Hall.
4:30 to 5:-15 p.m.	Inspection and Parade. V.M.I. Corps of Cadets. Parade Ground.
5:00 to 6:00 p.m.	Informal Reception. Alumni Hall.
8:00 p.m.	Virginia Academy of Science Assembly. Room 147, Mallory Hall.
	Welcome to V.M.I. by Major General George R. E. Shell, Superintendent of V.M.I.
	Short Business Meeting, Election of Officers.
	Presentation of the J. Shelton Horsley Research Award.

Guest Speaker: Dr. Arthur Roe, Head, Planning Group, National Science Foundation.

Subject: "Education for the Future"

The General Public is invited to attend.

SATURDAY, MAY 13, 1961

8:00 a.m.	Geology Field Trip. Leaders: Dr. Edward W. Spencer, and Dr. Kenneth F. Bick, Washington and Lee University. Box lunches required. Assemble Mallory Hall.
8:30 a.m.	General Field Trip, morning, Blue Ridge Parkway, leader: Donald H. Robinson, Chief Park Naturailst. Collecting is not permitted on the Parkway. Afternoon, George Washington National Forest, leader: William H. Cole, District Forest Ranger, Box lunches required. Assemble Mallory Hall.
8:30 a.m.	Biology Field Trip. Leaders: Colonel Robert P. Carroll, V.M.I. and Dr. A. B. Massey, V.P.I. The Harold Bailey bird and mammal collection at Rockbridge Alum Springs will be visited. Box lunches required. Assemble Mallory Hall.
8:30 a.m.	Cave Field Trip. Leaders: Cadets Frank F. Grayson, III and L. G. Fridley, Jr. Box lunches required. Assemble Mallory Hall.
9:00 a.m.	Section Meetings.
10:00 a.m.	Meeting of the Council of the Academy. Room 334, Mallory Hall.

Section of Agricultural Science

FRIDAY, MAY 12, 1961

SCOTT SHIPP HALL, ROOM 318

8:00 Call to order by Chairman. Announcements and Committee Appointments

1. 8:15 Lesser Peach Tree Borer Control in Virginia.
Marvin L. Bobb; Virginia Agricultural Experiment Station, Charlottesville

2. 8:27 The Use of "Living" Insecticides to Control the Cabbage Looper. R. N. Hofmaster; Virginia Truck Experiment Station, Painter

3. 8:42 Equipment for Narrow Band Irradiation of Hornworn Moths. J. M. Stanley and V. F. Earp; Agricultural Engineering Research Division, Agricultural Research Service and Agricultural Experiment Station

4. 8:57 Organic Chlorine Analyses of Toxaphene Residues on Leaf Crops. Douglas E. Greenwood; Virginia Truck Experiment Station, Norfolk

5. 9:12 The Application of Paper Chromatography to the Determination of Chlorinated Organic Pesticide Residues.
M. H. Lancaster and Boyd L. Samuel; Virginia Department of Agriculture

6. 9:27 Nutritive Value of Tannery By-product Meal for Chicks.
E. L. Wisman and R. W. Engel: Virginia Polytechnic Institute

7. 9:37 The Effect of Dietary Lysine Level Upon the Subsequent Nutritive Value of Pork: Growth and Nitrogen Balance of Rats.
Glenn M. Cahilly, Robert F. Kelly, and Russell F. Miller; Virginia Agricultural Experiment Station

8. 9:47 Studies on the Mechanism of Action of Mitochondrial Methylmalonyl Isomerase.
Carman S. Hegre and M. Daniel Lane; Virginia Polytechnic Institute

9. 9:59 Reversal of an Enzyme Lesion of Biotin Deficiency *In Vivo* and *In Vitro*.

David P. Kosow and M. Daniel Lane; Virginia Polytechnic Institute

10:11 Intermission

10. 10:25 Isotopic Nitrogen studies on the Catabolism of Essential Amino Acids
Edmond Chiu-choon Ku and Kendall W. King; Virginia Agricultural Experiment Station

11. 10:37 Properties of Phosphoenolpyruvate Carboxylase Isolated from the Germinating Peanut.
Hitoshi Maruyama and M. Daniel Lane; Virginia Polytechnic Institute

12. 10:49 Different Protein Levels in Purified Diets for Lambs.
Robert . Ho, J. P. Fontenot, W. E. C. Moore and K. W. King; Virginia Agricultural Experiment Station

13. 11:04 Use of Agronomic-Economic Data in Micro and Macro Analysis in the Georgia Piedmont.
D. B. Ibach; Farm Economics Research Division, Agricultural Research Service, Washington, D. C.

14. 11:20 Guest Speaker, W. Ralph Singleton, Director, The Blandy Experimental Farm, University of Virginia, Boyce. Mutagenesis—Experimental Alteration of the Germ Plasm (Its Theoretical and Practical Aspects).

12:00 Adjourn for lunch

15. 1:15 Evaluation of the North Country Cheviot Breed of Sheep in Crosses for Lamb Production.
Lilia Cesana and R. C. Carter; Virginia Agricultural Experiment Station

16. 1:30 Inheritance of Horns in Dorset Sheep.
Elmer Krehbiel and C. C. Mast; Virginia Agricultural Experiment Station

17. 1:45 Some Factors that Influence the Sale Price of Purebred Hereford Cattle in Southwest Virginia.
Thomas J. Marlowe; Virginia Polytechnic Institute

18. 2:00 Effects of Stage of Estrus, and Other Factors, Upon Concepton Rate n Beef Cows Bred Artificially.
K. P. Bovard and B. M. Priode; Virginia Agricultural Experiment Station and U. S. Department of Agriculture, Front Royal

19. 2:12 A Comparison of Sudoriferous Glands in Some Fine and Coarse Wool Sheep, and in Dairy and Angoro Goats.
Lubow A. Margolena; Animal Husbandry Division, Agricultural Research Service, Beltsville, Maryland

20. 2:27 Pathogenicity of *Eimeria gallopavonis* of Turkeys.
Marion M. Farr; Animal Disease and Parasite Research Service, Beltsville, Maryland

21. 2:34 Studies on *Leucocytozoon smithi* Infections in Turkeys, with Observations on the Tissue Stages of the Parasite.
Everett E. Wehr; Animal Disease and Parasite Research Division, Agricultural Research Service, Beltsville, Maryland

2:41 Intermission

22. 2:53 Soil and Plant Variability in a Uniformity Study with Virginia-Type Runner Peanuts.
D. L. Hallock; Virginia Agricultural Experiment Station, Holland

23. 3:08 Mechanical Obliteration of Plot Boundaries in Soil Fertility Research.
W. W. Moschler; Virginia Agricultural Experiment Station

24. 3:18 Field Observation of Soils with Fragipan Horizons in Prince William County, Virginia.
W. J. Meyer, D. L. Kaster, and J. F. Derting; Virginia Agricultural Experiment Station, Manassas

25. 3.33 Further Studies with Tributyl-2,4-dichlorobenzylphosophonium Chloride (Phosfon) as a Height-Retardant on Ornamentals.
Charles R. Downing and Staley L. Felton; Virginia-Carolina Chemical Corporation

26. 3:48 Culture of the Soybean Cyst Nematode.
Grover C. Smart, Jr.; Virginia Agricultural Experiment Station, Holland

4:00 Business meeting

Section Of
Astronomy, Mathematics And Physics

FRIDAY, MAY 12, 1961, MALLORY HALL, ROOM 111

1. 9:15 A Demonstration Field Tank for Triodes.

Edward F. Turner, Jr., Washington and Lee University

2. 9:30 Thorium Resonance Escape Probability by the Monte Carlo Method.
David L. Bushnell, Virginia Polytechnic Institute

3. 9:45 An Experiment to Measure Sensitive Cross Sections of a Bacteria (E. Coli) to Fast Neutrons from the D-T Reaction.
William E. Keefe, Virginia Polytechnic Institute

4. 10:00 Radio Star Scintillation.
James P. Hollinger, University of Virginia

5. 10:15 Two Component Scintillation Decay of Stilbene.
R. L. Bowles and A. D. Campbell, University of Richmond, now at NASA, Langley Field

6. 10:30 Compressibilities and Phase Transitions in Solid SiH_4, SF_6, HCl and HBr at High Pressures.
John W. Stewart, University of Virginia

7. 10:45 Recombination of Ions in Flames.
Irving R. King, Texaco Experiment, Inc.

8. 11:00 Heat Flow Problem in Rods of Varying Cross-Section.
D. Rae Carpenter, Jr. Virginia Military Institute

9. 11:15 Magnetically Suspended Molecular Pumps.
G. E. Williams and J. W. Beams, University of Virginia

10. 11:30 The Measurement of Very Low Air Pressures.
J. W. Beams, University of Virginia

11. 11:45 Protein Molecular Weights.
L. A. Sluga, R. D. Boyle and P. E. Hexner, Universtiy of Virginia

12:00 Lunch

1:45 Business Meeting

12. 2:15 Rotational Energy Losses of a High Speed Ultracentrifuge.
J. P. Wade, D. Spitzer and J. W. Beams, University of Virginia

13. 2:30 Measurements of Magnetic Field in Synchrotron.
W. A. Walker and W. D. Whitehead, University of Virginia.

14. 2:45 A Neutron Polarimeter Employing A Liquid Helium Scintillant.
J. T. Rogers and C. D. Bond, Virginia Polytechnic Institute

15. 3:00 P Wave Strength Functions of Elements Near A=100.
Keith Furr, Virginia Polytechnic Institute

16. 3:15 Proton Bombardment of Beryllium at 2.56 mev. Joseph Stoltzfus, Virginia Polytechnic Institute

17. 3:30 Infrared Absorption in Neutron Irradiated Silicon. J. S. Harne and T. E. Gilmer, Jr., Virginia Polytechnic Institute

18. 3:45 Structure and Mechanical Properties of Thin Gold Films. H. C. Fitz, Jr., University of Virginia

19. 4:00 Formation Conditions and Structure of Thin Epitaxial Silver Films on Rocksalt. Billy W. Sloope and Calvin O. Tiller, Virginia Institute for Scientific Research.

20. 4:15 Temperature Dependence for Electrical Resistance and Crystal Structure of Metallic Cerium. Kazuteru Shimura, Virginia Polytechnic Institute

21. 4:30 Direct Conversion of Heat to Electrical Energy Using Magneto Hydrodynamic Principles. John R. Sevier, Jr., College of William and Mary.

22. 4:45 Angle Sensitivity of a Solicon Cell as a Sola Sensor. Paul Spencer, College of William and Mary.

Section Of Bacteriology

FRIDAY, MAY 12, 1961

MALLORY HALL

2:00 Constancy of Specific Strains of *Staphylococus aureus* in a Selected Population. Holmes T. Knighton, Medical College of Virginia.

2:20 The Accelerated Macrophage Response to BCG in Rabbits. Bruce L. Fariss, University School of Medicine.

2:40 Studes on Antibody Production in Rabbit Lung. William B. Hunt, Jr., University of Virginia School of Medicine

3:00 The Serology of Lacto Bacilli. P. Arne Hansen, University of Maryland.

3:20 Staining of Animal Tissues with Fluorochromes.

Charles T. Hall, University of Maryland.

3:40 *Toxoplasma gondii* Infection of Tissue Culture Cells and Animals.
James B. Bell, Jr., University of Virginia School of Medicine.

4:00 D-arabinokinase from *Propionobacterium pentosaceum.*
Wesley A. Volk, University of Virginia School of Medicine.

Section Of Biology

FRIDAY, MAY 12, 1961. MALLORY HALL, ROOM 147.

1. 9:00 Southward Dispersal into Virginia of the Evening Grosbeak.
Joseph James Murray; Lexington, Virginia

2. 9:15 Twelve Native Plants from Shenandoah and Frederick Counties, Virginia.
Lena Artz; Waterlick, Virginia

3. 9:30 Derivations of the Yellow Cooperias.
R. O. Flagg; The Blandy Experimental Farm, University of Virginia

4. 9:45 Anaphylaxis in Young Chickens.
Joanne Graziani; Randoph-Macon Woman's College

5. 10:00 Chromosomes and Generic Status of *Pyrolirion.*
W. S. Flory and R. O. Flagg; The Blandy Experimental Farm, University of Virginia

6. 10:15 Hybridization of Native American Lilies.
A. M. Showalter; Madison College

7. 10:30 The Buccal Infraciliature of *Sathrophilus* (*Saprophilus*) *musrum* (Kahl, 1931) Corliss, 1960.
Jesse C. Thompson, Jr. and Margaret Virginia Cone; Hollins College

8. 10:45 Nucleic Acids and Root Geotropism.
Robert T. Brumfield and Marvin W. Scott; Longwood College

9. 11:00 Invitation Paper. Biology in the Antarctic.
Madison E. Pryor; University of Tennessee

10. 12:00 Rabbit Pellet Durability.
Paul P. Woronecki; Virginia Polytechnic Institute

11. 12:15 Preliminary Studies on York Diver Infauna.
Marvin L. Wass; Virginia Fishery Laboratory, Gloucester Point

12:30 Section Business Meeting

12. 2:00 Invitation Paper. The Multiple Molecular Forms of Functionally "Identical" Macromolecules: A Central Problem of Embryology, Physiology, and Systematics.
George W. Nace; Department of Zoology, University of Michigan.

13. 3:00 The Use of a Glass Differential Microrespirometer in Measureing Oxygen Uptake of Planarian Fragments Treated with Na-L-Thyroxine.
William L. Mengebier; Madison College.

14. 3:15 Preliminary Observations on Neurosecretion in the Supraesophageal Ganglion of the Crayfish.
D. Hugh Puckett and Jean E. Pugh; Norfolk College, William and Mary

15. 3:30 A study of the Effects of Thiourea on the Thyroid, Liver and Kidney of the Chick Embryos.
Jane Lee Oliver; Randolph-Macon Woman's College.

16. 3:45 Observations on the Growth and Reproduction Cycles of *Hydatigera lyncis* in an Experimental Host.
Harry L. Holloway, Jr.; Roanoke College

17. 4:00 Location and Examination of the Blackbird Roost in Dismal Swamp.
Joe W. Hardy; Virginia Polytechnic Institute.

18. 4:15 The Need for Geological Considerations in Wildlife Management. Robert H. Giles, Ohio State University, and Robert P. Carroll, V.M.I.

19. 4:30 Blood-oxygen Capacity of *Columbia livia.*
James R. Powell, University of Richmond

Section Of Chemistry

FRIDAY, MAY 12, 1961 — 9:00 A. M. — ROOM 104,

MAURY-BROOKE HALL, V.M.I

9:00 Announcements. Introductory Remarks.

1. 9:15 Atomic and Molecular Models.
John H. Wise and Edward B. Eadie, Jr..; Department of Chemistry, Washington and Lee University

2. 9:30 Corrosion of Alumnium in Vapors of Acid Solutions.
Herman H. Forsten and Nelson F. Murphy; Department of Chemical Engineering, Virginia Polytechnic Institute

3. 9:45 Twin Growth Structures on Single Crystal Catalyst Surfaces.
W. A. Jesser and K. R. Lawless; Department of Chemistry, University of Virginia

4 10:00 The Mechanism of Schiff Base Formation.
Thomas I. Crowell, Charles E. Bell, Jr., and Daniel H. O'Brein; Department of Chemistry, University of Virginia

5. 10:15 Reaction of Ammonia with an Aromatic Amine in Dilute Solution. Richard K. McLeod and Thomas I. Crowell; Department of Chemistry, University of Virginia

6. 10:30 Surface Tension and Intermolecular Energy of Pure Non-Polar Organic Liquids.
Ralph G. Steinhardt, Jr., and Leslie L. Williams; Department of Chemistry, Hollins College

7. 10:45 A New Spectrophotometric Reagent for the Determination of Traces of Magnesium.
D. Betteridge and John H. Yoe; Pratt Trace Analysis Laboratory, Department of Chemistry, University of Virginia

8. 11:00 A Study of Some Hydroxamic Acids as Spectrophotometric Reagents in Trace Metal Analysis.
Virgina C. Chamblin and John H. Yoe; Pratt Trace Analysis Laboratory, Department of Chemistry, University of Virginia

9. 11:15 The First and Second Ionization Constants of Phenolphthalein.
H. H. Garretson, James Charles, and Clarence McCanna; Lynchburg College

10. 11:30 A Report on the Partial Chemical Analysis of Horse Chestnuts.
Otey Helm Hayward; Department of Chemistry, Mary Baldwin College

11. 11:45 Boy Scouting and Chemistry.
Francis Garner and Donald F. Nieman; Alpha Chi Sigma, University of Virginia

12:00 Business Meeting.

12. 1:30 The Temperature Distribution in a Free Burning Cigarette.
J. S. Osborne, Jr., and A. Eward Wright, Jr.; Department of Research and Development, The American Tobacco Company

13. 1:45 Conversion of Nicotine to Nornicotine in Harvested Tobacco: Fate of the Methyl Group.
W. Stepka and L. J. Dewey; Department of Research and Development, The American Tobacco Company and Depart- of Physiology and Biochemistry, Medical College of Virginia.

14. 2:00 Phenyl Group Migrations in Highly Phenylated Systems.
John I. Dale, Robert E. Lutz, and C. L. Dickerson; Department of Chemistry, University of Virginia

15. 2:15 Conjugate Reactions of Phenoxides with 8-Bromo-8-Aroylacrylic Acids.
Joseph P. Feifer and Robert E. Lutz; Department of Chemistry, University of Virginia

16. 2:30 Ring Chain Tautomerism in the Cis-8-Bromo and 8-Methyl-8-Aroylacrylic Series.
Robert E. Lutz, Henry Moncure, Jr., and Joseph P. Feifer; Department of Chemistry, University of Virginia

2:45 Recess.

17. 3:00 Some Uses and Abuses of Phosphorus Compounds in Organic Chemistry.
William R. Smithey, Jr.; Research and Development Department, Virginia-Carolina Chemical Corporation.

18. 3.15 Some Aspects of the Chemistry of the Trialkyl Phosphites.
Wendell M. Byrd, Jr., and Vasco G. Camacho; Research and Development Department, Virginia-Carolina Chemical Corporation

19. 3:30 The Synthesis of Hydrazidomalonic Acid and Its Use as a Carbonyl Reagent.
James K. Shillington, Rardon D. Bevill III, and Henry C. Hawthorne, Jr.; Department of Chemistry, Washington and Lee University

20. 3:45 The Synthesis and Reactions of 7-(2-Carboxypheny1)Benz [a] anthracene.
Frank A. Vingiello and Edward J. Greenwood; Department of Chemistry, Virginia Polytechnic Institute

21. 4:00 Syntheses from 15-Oxygenated Steroidal Sapogenins.
Thurman T. Grossnickle, Horst Jenssen, and Clifton H. Wilson;

Department of Chemistry, Bridgewater College

22. 4:15 Some Reactions of p-Bromophenylferrocene and m-Bromophenylferrocene.
Allen K. Clark, W. F. Little, C. Noe, and J. Benner; Norfolk College of William and Mary, and University of North Carolina

23. 4:30 Aromatic Ketals.
Alexej Borkovec, Judith B. Chapman, and Elizabeth Anne Greene; Department of Chemistry, Hollins College

Section Of Engineeing

Friday, May 12, 1961 — Nichols Engineering Building, Room 505

9:00 Heat and Mass Transfer During Desublimination.
James R. Booth and Nelson F. Murphy, Chemical Engineering Department, Virginia Polytechnic Institute.

9:15 Design and Analysis of the University of Virginia ubcritical Assembly.
Lt. N. W. Spark, Reactor Facility, University of Virginia, Charlottesville.

9:30 Parametric Study of the Effects of Non-Equilibrium Flow In Nuclear Rocket Propulsion.
Major J. A. Stuart, Aerospace Engineering Department, Virginia Polytechnic Institute.

9:45 Flow of Excess Carriers in Entrinsic Semiconductors.
William W. Pettus and R. L. Ramey, Chemical Engineering Department, Universtiy of Virginia, Charlottesville.

10:00 The Solar Sail as A Means of Interplanetary Travel.
Lt. T. C. West, Aerospace Engineering Department, Virginia Polytechnic Institute

10:15 What Engineers and Scientists Should Know About Patents.
Auzille Jackson, Jr., Patent Counsel, Reynolds Metals Company, Richmond, Va.

10:30 Analysis of Velocity Selectors for Molecular Beams.
H. J. Davies, Jr., Aeronautical Engineering Department, University of Virginia, Charlottesville.

10:45 A Study of the Mechanism of Diffusion During Lamination of

Polar and Non-Polar Thermoplastic Materials.
George N. Foster and Stuart B. Row, Chemical Engineering Department, Virginia Polytechnic Institute.

11:00 Laboratory Demonstration Model of a Plasma Thermocouple.
K. L. Crosbie, Reactor Facility, University of Virginia, Charlottesville.

11:15 Skin Friction in Unsteady Slip Flow.
H. A. Hassan, Aerospace Engineering Department, Virginia Polytechnic Institute.

11:30 Molecular Beam Scattering From A Rapidly Moving Target.
John E. Scott, Jr., and Jackie O. Bunting, Aeronautical Engineering Department, University of Virginia, Charlottesville.

11:45 Factors Influencing Formation of Cr3O Type Structures in Alloy Systems.
E. E. Barton, Jr., and J. F. Eckel, Metallurgical Engineering Department, Virginia Polytechnic Institute.

12:00 Fuel Element Surface Temperature in the University of Virginia Reactor.
W. K. Brunot, Reactor Facility, University of Virginia, Charlottesville.

LUNCH

1:30 Vibration Studies of Highway Bridges.
H. L. Kinnier and J. M. Slepetz, Council of Highway Investigation and Research, Charlottesville.

1:45 The Ideal r-Times Ionized Monatomic Gas.
R. W. Truitt and J. N. Perkins, Aerospace Engineering Department, Virginia Polytechnic Institute.

2:00 Power Calibration and Flux Measurements of the University of Virginia Reactor.
I. I. Abdallah and M. Shafique, Reactor Facility, University of Virginia, Charlottesville.

2:15 Experimental Determination of Specific Heats of Various Abalting Materials at High Temperatures.
William Grossman, Aerospace Engineering Department, Virginia Polytechnic Institute.

2:30 Measurement of the Fermi Age of 14 Mev Neutrons in Paraffin and Water.
Capt. O. L. Doerflinger, Reactor Facility, University of Virginia, Charlottesville.

2:45 Summary of Theoretical and Experimental Studies of Ground Effect Machines.
J. B. Eades, Jr., and J. P. Frohlich, Aerospace Engineering Department, Virginia Polytechnic Institute.

3:00 An Orifice Probe Investigation of Free Molecular Curved Couette Flow.
J. W. Rich, Aeronautical Engineering Department, University of Virginia, Charlottesville.

3:15 Diffusion of Carbon in Dissimilar Metal Welds.
R. Louthan, and J. F. Eckel, Metallurgical Engineering Department, Virginia Polytechnic Institute.

3:30 Some Two Group, Multiregion Calculations for the University of Virginia Reactor.
V. D. Chatnis, Reactor Facility, University of Virginia, Charlottesville.

3:45 Temperature Boundaries for Ideal Dissociating and Ionizing Gases.
William P. Harrison, Jr., Aerospace Engineering Department, Virginia Polytechnic Institute.

4:00 An Experimental Aspect of the Production of Molecular Beams With A Hypersonic Nozzle.
John E. Scott, Jr., and Ricardo V. Zapata, Aeronautical Engineering Department, University of Virginia, Charlottesville.

4:15 A Stable Dosimeter for the Measurement of Ionizing Radiation.
Robert S. Durfee, Atlantic Research Corporation; A. R. Jones, Oak Ridge National Laboratories; C. J. Hochonadel, Oak Ridge National Laboratories and Stuart B. Row, Chemical Engineering Department, Virginia Polytechnic Institute.

4:30 The Role of Intuitive Methods in Engineering.
William Zuk, Civil Engineering Department, University of Virginia, Charlottesville.

4:45 Elastic Scattering in Molecular Beam Formation.
John E. Scott, Jr., Ricardo V. Zapate and James E. Drewry, Aeronautical Engineering Department, University of Virginia, Charlottesville.

5:00 Business Meeting and Election of Officers.

SATURDAY, MAY 13, 9:00 A.M.
VIRGINIA MILITARY INSTITUTE

9:00 Design of an In-Pile-Loop Experiment.
F. E. Moss, Reactor Facility, University of Virginia, Charlottesville

9:15 Real Gas Effects in Propulsion Performance.

J. E. Harris and R. W. Truitt, Aerospace Engineering Department, Virginia Polytechnic Institute.

9:30 Demonstration Instruments for Teaching Electrical Engineering.
Clifford M. Siegel, Electrical Engineering Department, University of Virginia, Charlottesville.

9:45 An Approximate Solution to the Properties of the Flow About a Blunt Body in a Hypersonic Stream.
R. N. Bell, Aerospace Engineering Department, Virginia Polytechnic Institute.

10:00 On the Use of a Physical Model in the Analysis of Shallow Spherical Spheres.
J. A. Friedericy, Civil Engineering Department, University of Virginia, Charlottesville.

10:15 The Determination of Heat Transfer Characteristics of a Moving Bed System Composed of Air and Activated Carbon.
William A. Barkley and Stuart B. Row, Chemical Engineering Department, Virginia Polytechnic Institute.

10:30 Thermodynamic Properties of Isobutylene Calculated from the Martin-Hu and Benedict-Webb-Rubin Equations.
Charles H. Barron, John C. Chaty, Raul A. Gonzalez and John W. Eldridge, Chemical Engineering Department, University of Virginia, Charlottesville.

10:45 A Physical Analogy for the Apsidal Motion of an Earth Satellite.
Gerald D. Walberg, Aerospace Engineering Department, Virginia Polytechnic Institute.

11:00 Neutron, Gamma Ray, and Heat Distribution in a Neutron Thermal Column.
Capt. B. F. Buck, Reactor Facility, University of Virginia, Charlottesville.

11:15 On the Motion of an Unsymmetrical Satellite.
C. Howard Robins, Jr., Aerospace Engineering Department, Virginia Polytechnic Institute.

11:30 Periodic Simulation — A Different Approach to Nuclear Reactor Kinetics.
K. L. Haynes and O. L. Updike, Reactor Facility, University of Virginia, Charlottesville.

11:45 Application of Electromagnetic Suspension Techniques to Research In Rarefied Gas Dynamics.
James E. May, Aeronautical Engineering Department, University of Virginia, Charlottesville.

Section Of Geology

Friday, May 12, 1961 — Mallory Hall, Room 442

9:00 Announcements

1. 9:10 Grundy rock fall.
   B. N. Cooper; Virginia Polytechnic Institute.

2. 9:25 Contact metamorphism in central Maine.
   J. M. Cole, Jr.; University of Virginia.

3. 9:45 A preliminary study of some tuffaceous rhythmites in southwestern Virginia.
   T. J. Carrington; Virginia Polytechnic Institute.

4. 10:00 Upper Cambrian trilobites from the Elbrook and Conococheague formations near Damascus, Virginia.
   James Derby; Virginia Polytechnic Institute.

5. 10:15 A preliminary study of the concretions in the Romney shale, Highland County, Virginia.
   C. E. Roberts; Washington and Lee University.

6. 10:30 X-ray diffraction identification of selected heat-treated metamict minerals from Virginia.
   F. B. Fitzgerald; University of Virginia.

7. 10:50 Some occurrences of paragonite in the Wissahichon formation of Virginia.
   M. G. Cook and C. I. Rich; Virginia Polytechnic Institute.

8. 11:05 Comments on the mineralogy at the Sulphur Mine, Mineral, Virginia.
   A. S. Katz; University of Virginia.

9. 11:25 Interaction between industrial effluent and suspended sediment at West Point, Virginia.
   B. W. Nelson; Virginia Polytechnic Institute.

10. 11:40 Linear features in the Spring Hill area, Augusta County, Virginia.
    R. L. Ellison; University of Virginia.

12:00 Recess.

11. 2:00 Proto-Paleozoic: rocks between Precambrian and fossiliferous Cambrian.

W. A. Nelson; University of Virginia.

12. 2:20 Comments on the structural petrology of some Cambrian and Precambrian rocks of the central Blue Ridge of Virginia.
V. S. Griffin, Jr.; University of Virginia.

13. 2:35 Field observations of soils developed on unconsolidated deposits in the Triassic area of Prince William County, Virginia.
D. L. Kaster, J. F. Derting, and W. J. Meyer; Virginia Polytechnic Institute.

14. 2:55 Reconnaissance magnetic survey of Mole Hill, Rockingham County, Virginia.
R. S. Young and D. K. Grubbs; University of Virginia.

15. 3:10 A diamictic conglomerate along the New River, Giles County, Virginia.
R. C. Hale; Virginia Polytechnic Institute.

16. 3:25 Ground water in Beekmantown dolomite, northern St. Lawrence County, New York.
F. W. Trainer; University of Virginia.

17. 3:45 Some aspects of recrystalline carbonates in the central Shenandoah Valley of Virginia.
F. H. Campbell III; University of Virginia.

18. 4:00 Comments on magnesium sulfate minerals formed in Brooks Museum on serpentine from Impruneta, Italy.
W. E. Workman and E. K. Rader; University of Virginia.

4:15 Business Meeting.

Saturday, May 13, 1961

8:00 Field trip

Section Of Medical Sciences

Friday, May 12, 1961 — Science Hall, Room 204

9:30 Experimental Bacterial Endocarditis.
W. B. Gross; Virginia Polytechnic Institute.

2. 9:45 Siginificant Bacteriological Monitoring of a Hospital Environment.
M. S. Rittenbury, Virginia DeJarnette and Miles E. Hench; Medical College of Virginia.

3. 10:00 Effect of Centrifugation at 20,000 x g on Lipid Distribution in Human Sera.
J. C. Forbes, P. D. Camp, A. J. Wasserman, W. T. Tucker, A. L. Forbes and O. M. Petterson; Medical College of Virginia

4. 10:15 Autoradiography in the Study of Amino Acid Metabolism.
W. R. Proffit; Medical College of Virginia.

5. 10:30 Studies of Human Renal Metabolism.
J. H. Magee, A. L. Forbes and W. P. Anslow, Jr.; McGuire V. A. Hospital, Medical College of Virginia and University School of Medicine.

6. 10:45 The Effects of Iodinated Salicylates on Metabolism.
C. L. Gemmill and K. M. Browning; University of Virginia School of Medicine.

7. 11:00 Metabolism of (-)-Cotinine in the Rat.
Sorell L. Schwartz, Edward R. Bowman and Herbert McKennis, Jr.; Medical College of Virginia.

8. 11:15 Biochemical Studies in Experimental Porphyria.
Lynn D. Abbott, Jr. and Susan G. Rudolph; Medical College of Virginia.

9. 11:30 Clinical Aspects of a Nutrition Survey of Thailand.
Allan L. Forbes, Jeffrey H. Fryer and Bertram D. Dinman; Medical College of Virginia and McGuire V. A. Hospital.

10. 11:45 Motion picture: Comparative Effects of X-ray and Ultraviolet Gamete Irradiation on Developing Sea Urchins.
Carl C. Speidel and Ralph H. Cheney; University of Virginia School of Medicine and Brooklyn College.

12:05 Business Meeting.

11. 2:15 The Effect of Dietary Molybdenum Upon the Enzyme Bone Alkaline Phosphatase.
Herman L. Johnson and Russell F. Miller; Virginia Polytechnic Institute.

12. 2:30 Mechanism of Action of the Enzyme Nitroaryl Reductase.
Edwin S. Higgins; Medical College of Virginia.

13. 2:45 Attempts to Obtain the Enzyme Preparation (Crysteine Oxidase) from Rat Skins.
Robert T. Rifkin and Russell F. Miller; Virginia Polytechnic Institute.

14. 3:00 An Immunochemical Analysis of the Chymotrysins.

C. L. Diggs and J. F. Albright; Medical College of Virginia.

15. 3:15 Proteolytic Assay of Canine Serum.
W. L. Farrison, M. S. Rittenbury and L. A. Mounter; Medical Colleeg of Virginia.

16. 3:30 The Influence of Saline Infusions of the Course of Barbiturate Intoxication.
Joseph F. Borzelleca; Medical College of Virginia.

17. 3:45 Toxicity of Peritoneal Fluid in Hemorrhagic Pancreatitis.
M. S. Rittenbury and Phyllis Darden; Medical College of Virginia.

18. 4:00 The Effect of Insulin on the Flux of Potassium in Isolated Frog Muscle.
D. R. H. Gourley; University of Virginia School of Medicine.

19. 4:15 Physiological Effects of a New Thyroid Hormone-like Substance Found in Duodenal Tissue.
C. J. Ackerman and V. Tsou; Virginia Polytechnic Institute.

20. 4:30 Characterization of Hemorrhagic Hypotensive Shock in the Cat.
Eugene D. Brand; University of Virginia School of Medicine.

Saturday, May 13, 1961 — 9:30 A.M.

21. 9:30 Problems in Enzyme Specificity.
L. A. Mounter; Medical College of Virginia.

22. 9:45 Fatty Acid Activation and Choline Ester Synthesis in Brain Tissues.
L. A. Mounter, H. G. White and H. A. Wellons; Medical College of Virginia.

23. 10:00 The Reaction of Hydrolytic Enzymes with Organophosphorus Compounds.
T. J. Woudenburg and L. A. Mounter; Medical College of Virginia.

24. 10:15 The Effect of Ionizing Radiation on Nucleotidases.
Ira A. Updike, Nita S. Rawls and L. A. Mounter; Medical College of Virginia.

25. 10:30 Comparative Study of Ageing and Ionizing Radiation on the Rabbit Lens.
William T. Ham, Jr.; Medical College of Virginia.

26. 10:45 Titrimetric Analysis of Lens Proteins.

E. R. Berry and R. C. Williams; Medical College of Virginia.

27. 11:00 Curve Fitting Techniques with an Analog Computer.
F. H. Schmidt and M. E. Turner; Medical College of Virginia.

28. 11:15 Physical Characteristics of High Irradiance Pulses.
R. S. Ruffin, R. C. Williams, F. H. Schmidt and William T. Ham, Jr.; Medical College of Virginia.

Section Of Psychology

FRIDAY MORNING, MAY 12, 1961 — 9:00 A. M.

MALLORY HALL, ROOM 454

AUSTIN GRIGG, CHAIRMAN

1. 9:00 Stimulus Similarity and Frequency of Occurence in the Identification of Ambiguous Visual Forms.
James H. Brown, University of Virginia

2. 9:15 The relationship of Rorschach productivity to overt psychiatric symptomatology: a test of Phillips and Smith's hypothesis.
Henry B. Adams and G. David Cooper, VA Hospital, City of Richmond

3. 9:30 A Study in Overcoming Boredom and Fatigue in a Monotonous Task.
Patsy Mantzz, College of William and Mary

4. 9:45 Psychological Perspective on the Concept of Work.
Jacob Silverberg, The Memorial Guidance Clinic, City of Richmond.

5. 10:00 The Effects of Suggestion and of Benzadrine and Meprobamate on Motor Performance.
Leonard E. Jarrard, Washington and Lee University

6. 10:15 Performance as Jointly Determined by Concentration of Sucrose and Duration of Food Deprivation.
James H. Woods, University of Virginia

7. 10:30 INTERMISSION

8. 10:45 Symposium: On Recent Developments in Physiological Physchology with Implications for the Control of Behavior.

9. 12:30 Lunch—Committee Meetings
L. S. Reid, Chairman

10. 2:00 Sources of Interference in Verbal Paired Associate Learning.
Sam C. Brown, University of Virginia

11. 2:15 A Serial–learning Effect within the Perceptual Span.
E. Rae Harcum and Rosemary Hartman, College of William and Mary

12. 2:30 A Further Investigation of the Relationship between Anxiety and Digit Symbol Performance.
Robert A. Johnston and *Herbert J. Cross*, University of Richmond

12. 2:45 Effects of simultaneous vs. successive presentation on hemifield differences within the perceptual span.
David S. Camp, College of William and Mary

13. 3:00 Discrimination Base Lines in Drug-Behavior Interaction.
Arthur J. Bachrach, University of Virginia School of Medicine

14. 3:15 The Counterbalancing Effects of Two Antagonistic Drugs as Determined by Bar Pressing and Activity in the Rat.
Clarence M. Whitehead, Jr., Washington and Lee University

15. 3:30 The Influence of Prior Reinforcement History upon Activity During Deprivation
James F. Campbell, University of Virginia

16. 3:45 The effects of rehearsal on unaided recall of nonsense syllables.
James H .Crouse, College of William and Mary

17. 4:00 Effects of noxious stimulation and ego-threat of memory.
John H. Borghi, College of William and Mary

18. 4:15 Brainwashing in Reverse
Lt. John L. Miles, Jr., The United States Army Infantry School, Fort Benning, Georgia

19. 5:30 Business Meeting

20. 5:30 Social Hour and Dinner—V.P.A.

SATURDAY MORNING, MAY 13, 1961—9:00 A.M.

E. Rae Harcum, *Chairman*

1. 9:00 The Effects of the Color of Numbers and Backgrounds on

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the Perception of Tachistoscopically Present Numbers.
Richard S. Schulist, Washington and Lee University

2. 9:15 The Effect of Logical Grouping on Performance in a Short-Term Retention Task.
Russell B. Johnson, Unievrsity of Virginia.

3. 9:30 Error-Contours for Binary Patterns as a Function of Practice.
Dorothy W. Dyer and E. Rae Harcum, College of William and Mary

4. 9:45 Some effects of three dosages of alcohol on the anticipatory response in rats.
Nelson F. Smith, College of William and Mary

5. 10:00 Overt Behavioral Corerlates of the Klopfer Rorschach Prognostic Rating Scale: A Validity Study
Henry B. Adams and G. David Cooper, VA Hospital, City of Richmond

6. 10:15 Reversal of strong and weak habits under high and low drives.
Maurice E. Wilson, College of William and Mary

7. 10:30 The Role of Direct Social Interaction upon Learning in a Minimal Social Situation.
Douglas H. Macpherson, University of Virginia

9. 10:45 Effect of Letter-symmetry on Distribution of Errors in Tachistopscopic Letter-targets
Read Bromleigh, College of William and Mary

9. 11:00 The Effects of High and Low Drives on Negative Transfer in a Maze Learning Situation.
Drew P. Danko, Washington and Lee University

10. 11:30 Business Meeting—V.P.A.

Section Of Science Teachers

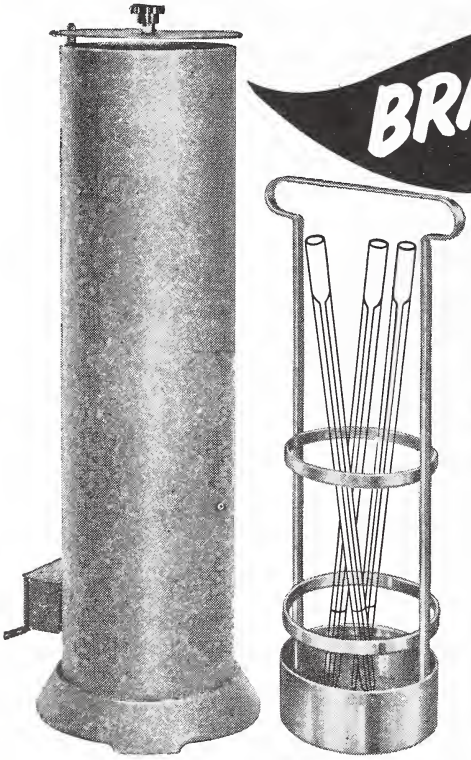
Virginia C. Ellett, *Chairman*

Robert Horne, *Chairman Elect*

Vera Remsburg, *Secretary*

Alan Mandell, *Section Editor*

THURSDAY, MAY 11, 1960. 1:15 P.M. — MALLORY HALL, ROOM 111



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THEME: "Trends in Science Teaching."

1:15 Business Session

1. 1:30 "Science Trends in Virginia"
   Franklin D. Kizer; State Supervisor of Science

2. 1:50 "Reactions of the College to Advanced Placement Courses."
   Alfred R. Armstrong; Chemistry Department, College of William and Mary

3. 2:10 "Reactions of the Student to Advanced Placement Courses."
   Meade Christian, Washington and Lee University

4. 2:30 "Chemical Bond Approach."
   Martha L. Walsh; McLean High School

5. 2:50 "Biology Curriculum Trends and Moves."
   Vera Remsburg; Herndon High School

Section Of Statistics

FRIDAY, MAY 12, 1961 — 9:00 A.M.

MALLORY HALL, ROOM 252

Medical and Biological Statistics

9:00 Remarks by Chairman

9:05 Sequential allocation of patients in clinical trials.
R. J. Taylor, Virginia Polytechnic Institute

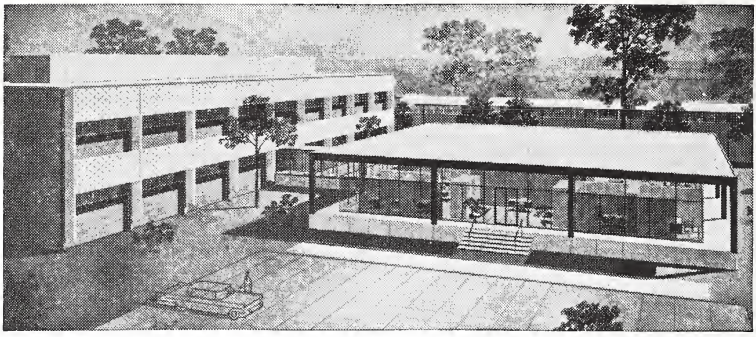
9:30 The iterated gamma distribution.
A. Timothy Ewald, Medical College of Virginia

9:55 Modification of the Enzyme substrate interactions of the enzyme acetylcholinesterase.
George M. Angleton, Medical College of Virginia

10:30 Some additional procedures for the detection of epistasis.

GENERAL TOPICS

10:30 Some additional procedures for the detection of epistasis.
Theodore W. Horner, Booz Allen Applied Research, Inc.



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10:20 Intermission

10:55 Probability models for choice behavior.
Herbert A. David, Virginia Polytechnic Institute.

11:20 Distribution of the maximum of equi-correlated normal variables.
Charles C. Thigpen, Virginia Polytechnic Institute

FRIDAY, MAY 12, 1961 — 2:00 P.M.

MALLORY HALL

Statistics and Computers

2:00 Some problems in the construction of statistical computer programs.
Rolf E. Bargmann, Virginia Polytechnic Institute

2:50 Automatic generation of pseudo random numbers.
Frederic C. Clodius, Naval Weapons Laboratory

3:15 Some comments on computer science
Rudolf J. Freund, Virginia Polytechnic Institute

3:40 Business Meeting

SATURDAY, MAY 13, 1961 — 9:00 a.m.

MALLORY HALL

9:00 The estimation of the parameters of a linear regression system obeying two different regimes.
Walker G. Madison, National Aeronautics and Space Agency

9:25 Prediction of the composition of a ternary mixture.
Ray Myers, Virginia Polytechnic Institute.

9:50 A demand analysis problem with non linear aspects.
David C. Hurst, Virginia Polytechnic Institute

10:30 Intermission

10:40 A matrix inequality.
Geoffrey A. Watterson, Virginia Polytechnic Institute

11:15 Analysis of missing values in a balanced incomplete block design.
H. A. Baird, National Institutes of Health

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Contributions to the Journal should be addressed to Robert D. Ross, Virginia Polytechnic Institute, Blacksburg, Virginia. If any preliminary notes have been published on the subject which is submitted to the editors, a statement to that effect must accompany the manuscript.

Manuscripts must be submitted in triplicate, typewritten in double spacing on standard 8½" x 11" paper, with at least a one inch margin on all sides. Manuscripts are limited to seven pages, with the proviso that if additional pages are desired, the author may obtain them at cost. The author may estimate the length of his paper by counting the total number of characters, including blank spaces, and dividing this by 3300. The result is the approximate number of printed pages in the Journal.

Division of the manuscripts into subheadings must follow a consistent plan, and be held to a minimum. It is desirable that a brief summary be included in all manuscripts.

Footnotes should be included in the body of the manuscript immediately following the reference, and set off by a dashed-line above and below the footnote content. Footnotes should be numbered consecutively from the beginning to the end of the manuscript.

Bibliographies (Literature Cited, References, etc.) should be arranged alphabetically according to author. Each reference should include the date, full title of the article, the name of the Journal, the volume, number (optional), pages, tables and figures (if any). For example: "Sniffen, Ernest W. 1940. Cobbles from the Pleistocene Terraces of the Lower York-James Peninsula Va. Journ. Sci., 1 (8): 235-288 1 fig., 1 tab. Reference to the bibliographic citations should not be made by numbers. Instead, using the above citations, where a reference is desired: either "Sniffen (1940)", (Sniffen, 1940: 186)", or "Sniffen (1940) states that . . ."

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